Results of forest insect and disease surveys in the SOUTHWESTERN REGION of Ontario, 1989

CARRIED OUT BY THE GREAT LAKES FORESTRY CENTRE IN COOPERATION WITH THE ONTARIO MINISTRY OF NATURAL RESOURCES

E.J. Czerwinski and W.D. Biggs

Miscellaneous Report No. 91

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FORESTRY CANADA, ONTARIO REGION

Ontario Region is one of six regional establishments located across Canada and operated by Forestry Canada. The overall objective of Forestry Canada is to promote the preservation, enhancement and wise use of a healthy, attractive and bountiful forest resource and terrestrial environment for the economic and social benefit of all Canadians. Ontario Region pursues this objective by conducting two major programs: research and technical services and forestry development. Both programs address major problems affecting forest management and the forest environment primarily in Ontario, but because of the transprovincial nature of the forest resource, many elements of our research program are of national significance.

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Close working relationships are maintained with the Ontario Ministry of Natural Resources, the forest industry, educational institutions specializing in forestry and the biological sciences, and other forestry organizations within the province. Ontario Region is represented on the Ontario Forestry Council and the Ontario Forestry Research Committee, which have responsibility for coordinating forestry research in Ontario.

It is recognized that forested land must be managed in the best public interest, not only for the wood production essential to our economy, but also for the recreational purposes that are so important to our social well-being. This must be achieved in a manner that will maintain or improve the quality of the forest environment and preserve it for generations to come.

RESULTS OF FOREST INSECT AND DISEASE SURVEYS IN THE SOUTHWESTERN REGION OF ONTARIO 1989

(FOREST DISTRICTS: OWEN SOUND, WINGHAM, CHATHAM, AYLMER and SIMCOE)

C. Czerwinski and W.D. Biggs

FORESTRY CANADA

ONTARIO REGION

GREAT LAKES FORESTRY CENTRE

1990

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SURVEY HIGHLIGHTS

This report deals with forest insects, diseases and abiotic conditions encountered in the course of regular and special surveys during the 1989 field season in the Southwestern Region of Ontario.

The most noteworthy and damaging pest in the region was the forest tent caterpillar, infesting some 46,290 ha in the Owen Sound District. Gypsy moth populations expanded exponentially and are expected to continue to increase in 1990. Cedar leafminer populations declined to endemic levels and oak leaf shredder populations remained low. In stands that can be compared, white pine weevil populations showed signs of decline. Results from specific surveys for the spruce budworm reveal a slight increase in populations.

Special surveys for the European and native races of the Scleroderris canker fungus again proved negative; however, tip blight continues to be a problem on exotic pines. Moisture-related damage was evident on a wide variety of hosts along roadsides and in planted areas, and is described under drought, scorch and physiological needle droop. Forest health plots continue to be monitored. Eastern white pine was the host evaluated in the Plantation Survey and the Seed and Cone Pest Survey. Special surveys for the pear thrips were initiated this year; it was recorded for the first time in the region, on sugar maple. A writeup on St. Williams Nursery inspections and a summary of climatic data are included in this report.

As in previous years, pests in this report are categorized as follows:

Major Insects/Diseases

capable of causing severe injury to or death of living trees or shrubs

Minor Insects/Diseases

capable of causing sporadic or localized injury but not usually a serious threat to living trees or shrubs

Other Forest Insects/Diseases (Tables)

These tables provide information on two types of pest:

(1) those that are of minor importance and have not been known to cause serious damage to forest trees

(2) those that are capable of causing serious damage but have not done so because of low populations or for other reasons.

The cooperation and assistance extended to the authors by Ontario Ministry of Natural Resources (OMNR) parks and district staff, by Conservation Authorities, by Parks Canada and other government agencies, and by various individuals are gratefully acknowledged.

E. Czerwinski

Frontispiece

Deterioration of roadside sugar maple (*Acer saccharum* Marsh.) trees

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INSECTS

Major Insects

Cedar leafminers, *Argyresthia aureoargentella* Brower, *A. canadensis* Free., *A. thuiella* (Pack.) and *Coleotechnites thujaella* (Kft.)

A marked reduction in populations of this pest of eastern white cedar (*Thuja occidentalis* L.) was noted across the region in 1989. In the Owen Sound District, leafmining in the 10-40% range was observed through Sauble, Saugeen and Amabel townships, giving the foliage a sparse appearance, whereas in the previous year, foliar browing was as high as 50-70% on the Bruce Peninsula. Foliar damage levels of 5% were reported in Turnberry Township, Wingham District and were typical of those at all other locations in the Wingham, Chatham, Aylmer and Simcoe districts.

Spruce Budworm, *Choristoneura fumiferana* (Clem.)

Provincial Situation

A steady decline in spruce budworm populations has been evident in Ontario for the past several years, but in 1989 the trend was reversed. The overall area of moderate-to-severe defoliation increased from 5,224,734 ha in 1988 to 6,239,636 ha in 1989 and was again confined to the Northwestern and North Central regions of Ontario (Fig. 1). Smaller increases that caused light foliar damage were observed in a number of other districts in the Northern, Northeastern, Central and Southwestern regions.

Whole-tree and top mortality of balsam fir (*Abies balsamea* [L.] Mill.) and white spruce (*Picea glauca* [Moench] Voss) in the province increased by 3.7% in 1989, from 14,515,719 ha to 15,044,874 ha. These increases were confined to the Northwestern and North Central regions.

Aerial spraying operations were carried out on some 30,516 ha of spruce/fir forests in the Thunder Bay and Nipigon districts, North Central Region. The bacterial insecticide *Bacillus thuringiensis* (*B.t.*) was used exclusively for the purpose of minimizing defoliation in commercial stands, in a provincial park and in some plantations.

Southwestern Region

Spruce budworm populations have remained at endemic levels since 1981, but in 1989 a notable population was recorded in the Wingham District. Defoliation levels averaging 10-20% were observed on 15-m white spruce in an 18-ha plantation in the Smeale Tract of Minto Township, Wingham District. Small numbers of larvae were recorded in spruce stands within conservation areas in Downie and Ellice townships, Wingham District. Elsewhere in the region, populations remained low and caused no noticeable defoliation.

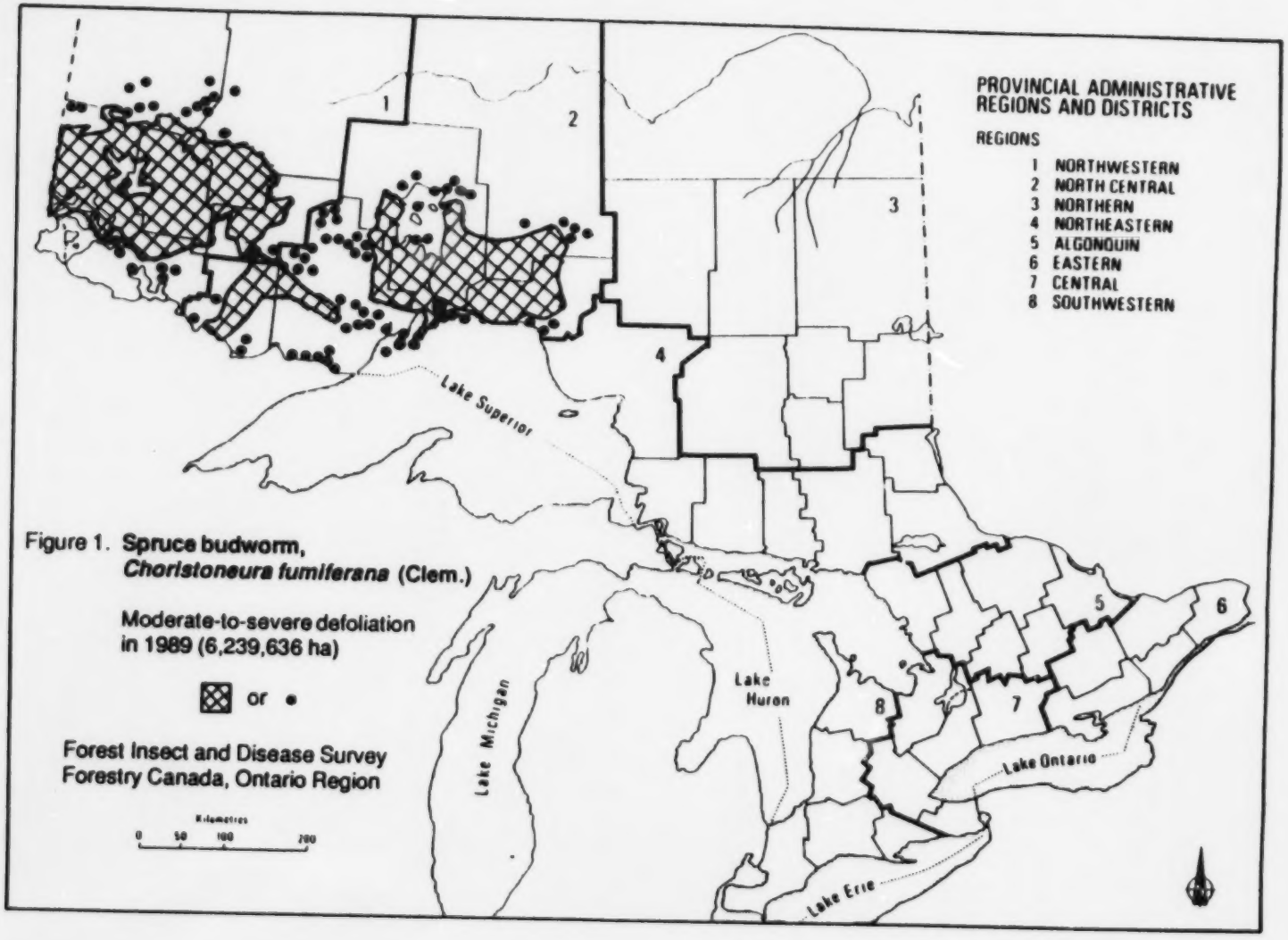

Figure 1. **Spruce budworm,**
***Choristoneura fumiferana* (Clem.)**

Egg-mass sampling for the purpose of forecasting populations was carried out at four locations. The results indicate that populations and foliar damage should remain at low levels in all areas sampled, except for the northeastern corner of Wingham District. Moderate damage is likely to occur in the Smeale Tract spruce plantation in Minto Township, Wingham District.

In conjunction with all regular surveys for the spruce budworm an additional pheromone trapping program was carried out. These pheromone traps were deployed in groups of three prior to the adult flight period. The bucket-type traps were equipped with a synthetic pheromone bait and a strip impregnated with a killing agent. The trapping program yielded from 2 to 488 moths at eight locations. The greatest number of moths was found in Minto Township, Wingham District, and reflected the growing population there. Other areas in which increased numbers of moths were recorded included the abovementioned conservation areas in Wingham District.

Larch Casebearer, *Coleophora laricella* (Hbn.)

Increased numbers of this early-season pest of tamarack (*Larix laricina* [Du Roi] K.Koch) and European larch (*L. decidua* Mill.) caused severe foliar browning in the region in 1989.

Foliar damage was most severe in planted and natural stands and on ornamental trees in Charlotteville and South Walsingham townships, Simcoe District, and in Osprey Township, Owen Sound District. Severe defoliation in the form of needle discoloration and premature needle drop affected 80-100% of the foliage; however, smaller amounts of foliar damage were recorded at many other sites in the region.

Oak Leaf Shredder, *Croesia semipurpurana* (Kft.)

In 1989, populations of this pest of red oak (*Quercus rubra* L.) and black oak (*Q. velutina* Lam.) remained at endemic levels. Surveys in the oak leaf shedder plots revealed that foliar damage has remained very low; less than 1% defoliation was recorded in the Bosanquet Township plot, Chatham District. Defoliation ranged from 60% to 82% in the two plots in Simcoe District, and was attributable to feeding by gypsy moth, *Lymantria dispar* (L.).

Defoliation estimates and pheromone trapping results obtained in 1989, along with infestation forecasts for 1990 based on egg counts, are given in Table 1. Analysis of these data is expected to indicate that populations of the oak leaf shedder will remain at endemic levels in these plots.

Table 1. Summary of the results of oak leaf shredder pheromone trapping and egg counts in 1989, and defoliation forecasts for 1990 in the Southwestern Region (five traps deployed at each location).

Location	No. of adults caught		Leaves attacked in 1989 (%)	Foliar damage in 1989 (%)	No. of eggs		Infestation forecast for 1990
	1988	1989			1988	1989	
Chatham District							
Bosanquet	N/A	0	1.5	0.2	N/A	0	nil
Simcoe District							
Charlotteville	0	1	86.0[a]	60.5[a]	0	0	nil
S. Walsingham	1	6	100.0[a]	81.8[a]	0	0	nil

[a] Gypsy moth was recorded as the causal agent.

Gypsy Moth, *Lymantria dispar* (L.)

In 1989, the area of moderate-to-severe defoliation caused by the gypsy moth increased 17 times over that recorded in 1988 and was again confined to Walsingham and Charlotteville townships, Simcoe District. Aerial and ground surveys revealed infestations totalling 4,807 ha in comparison with 240 ha in 1988 and 115 ha in 1987. In Simcoe District the majority of infested deciduous woodlots were mapped in pockets ranging in size from several hectares to several hundred hectares. The infestation was concentrated in a band 4.5 km wide starting east of Cultus in Walsingham Township near the area in which populations were first recorded in 1985, and running in a northeasterly direction to the Bill's Corner area in Charlotteville Township (Fig. 2). Two large pockets of oak, primarily black oak and white oak (*Q. alba* L.), totalling approximately 470 ha, were infested in Turkey Point Provincial Park, in the nursery tract in Haldimand Regional Forest and in the Normandale Creek area, Charlotteville Township. Three small pockets totalling approximately 28 ha were mapped northwest of the town of Langton.

Foliar damage on deciduous and coniferous hosts, mainly oaks and eastern white pine (*Pinus strobus* L.), ranged from a low of 25% on some trees to complete defoliation (100%) in most stands. In the stands defoliated earliest, a second growth of foliage began to be noticable in the third week of July; however, some larvae were observed feeding until the end of July in some areas. The coniferous hosts, namely eastern white pine, white spruce and Norway spruce (*P. abies* [L.] Karst.), did not produce a second growth of foliage. Far removed from the large infestation in the Simcoe District, light damage (10-25%) was observed in an 18-ha woodlot consisting mostly of red oak and bur oak (*Q. macrocarpa* Michx.), shagbark hickory (*Carya ovata* [Mill.] K.Koch.), green ash

CHATHAM, AYLMER and SIMCOE DISTRICTS

1. CHATHAM
2. AYLMER
3. SIMCOE

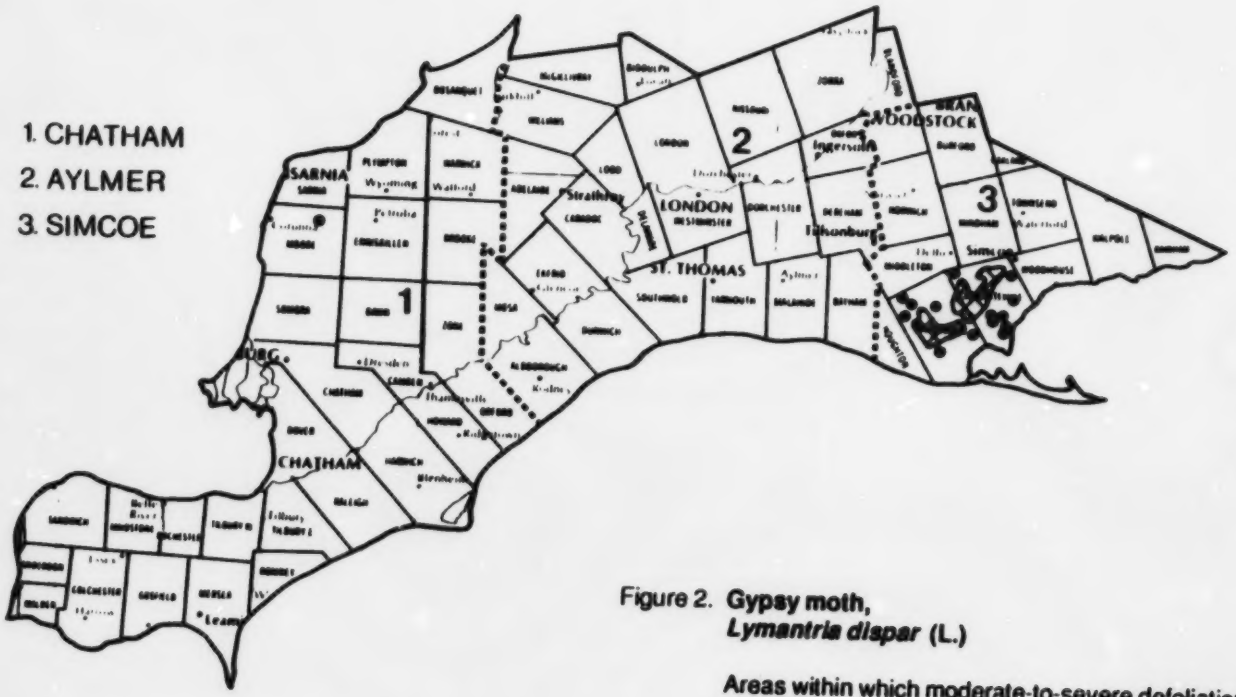

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Figure 2. **Gypsy moth,**
***Lymantria dispar* (L.)**

Areas within which moderate-to-severe defoliation occurred in 1989

▨ or ●

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Forestry Canada, Ontario Region

(*Fraxinus pennsylvanica* Marsh. var. *subintegerrima* [Vahl.] Fern.) and bluebeech (*Carpinus caroliniana* Walt. var. *virginiana [Marsh.]* Fern.) in Lot 3, Concession 1 of Moore Township, Chatham District. Small numbers of larvae were observed at many other locations across the region.

Positive results were obtained from the burlap trapping program at seven of the 11 provincial parks sampled. The greatest numbers of larvae were recorded at Turkey Point Provincial Park, Simcoe District, where an average of 272.2 larvae were caught at each sample point. For the first time in the region, larvae were caught at Ipperwash and Pinery provincial parks, Chatham District and at Point Farms Provincial Park, Wingham District (Table 2).

Table 2. Results of the gypsy moth burlap and pheromone trapping program in 1988 and 1989 in the Southwestern Region.

Location (Park)	No. of burlap traps	Avg no. of larvae/ observation		No. of pheromone traps	Avg no. of male moths caught/trap	
		1988	1989	1989	1988	1989
Aylmer District						
Port Burwell[a]	10	0	0	2	15	34
Chatham District						
Holiday Beach Conserv. Area	N/A	N/A	N/A	2	11	14
Ipperwash	10	0	5	1	17	29
Pinery	10	0	0.5	2	19	25
Point Pelee Natonal Park	N/A	N/A	N/A	1	N/A	26
Rondeau	10	0.8	0.8	2	7	41
Wheatley	N/A	N/A	N/A	2	N/A	66
Simcoe District						
Long Point	10	2.5	0.2	2	25	28
Selkirk	10	4.3	31.0	2	15	31
Turkey Point	10	30.0	272.2	2	32	86
Owen Sound District						
Craigleith	10	0.0	0.0	2	20	22
Crane River	N/A	N/A	N/A	2	10	22
MacGregor's Point	10	0.0	0.0	2	19	27
Sauble Falls	10	0.0	0.0	2	13	24
CFTA Meaford	N/A	N/A	N/A	10	9	22
Wingham District						
Point Farms	10	0	2.5	2	15	22

[a] formerly Iroquois Beach Provincial Park

N/A: not trapped in study years

Results of a slightly expanded pheromone trapping program in 1989 indicate positive catches again at all sites. In all cases there was an increase in the number of male moths captured, ranging from a low of 14 adults per trap at Holiday Beach Conservation Area, Chatham District to a high of 86 adults per trap at Turkey Point Provincial Park, Simcoe District (Table 2.).

In parks in which burlap trapping produced positive results and at other selected sites, a line search or modified Kaladar plot was completed to detect egg masses. The greatest egg-mass densities were encountered in areas of known infestations. At Turkey Point Provincial Park, Simcoe District, 52,300 egg masses/ha were recorded and in Moore Township, Chatham District, the survey revealed 35,400 egg masses/ha (Table 3). On the basis of these results and of general observations throughout the work area it is expected that gypsy moth infestations will continue to grow and expand in the Simcoe District, spreading north of Highway 3, west of Simcoe and further west into Aylmer District. Results of the surveys completed in Moore Township, Chatham District indicate a growing population in that area and in the surrounding woodlots. Moderate-to-severe defoliation can be expected to occur there in 1990. A separate infestation is building in Wheatley Provincial Park, Chatham District, where surveys in 1989 revealed 16,700 egg masses/ha and moderate-to-severe defoliation can be expected in 1990.

In 1989, a protection program was initiated in the Simcoe District to protect foliage from feeding by gypsy moth. A 261-ha area owned by the Backus Conservation Authority and managed in conjunction with OMNR was aerially sprayed with *Bacillus thurengiensis (B.t.)*, a bacterial insecticide.

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

The area of moderate-to-severe defoliation caused by forest tent caterpillar in the Owen Sound District in 1989 increased by almost 10 times over that recorded in 1988. All together, some 46,290 ha of forested land in the Owen Sound District were defoliated in 1989, in comparison with 4,760 ha in 1988. Moderate-to-severe (75-100%) damage, mainly to trembling aspen (*Populus tremuloides* Michx.) and sugar maple (*Acer saccharum* Marsh.), was found in four distinct areas (see photo page). The largest of these was over 18,000 ha in size and covered most of Keppel Township. The next largest single area mapped was 9,217 ha in size and was located in the eastern parts of Albemarle and Eastnor townships. Two other areas of damage, each about 8,000 ha, were found for the most part in Euphrasia, Holland and Sydenham townships, with some smaller extensions into St. Vincent Township (Fig. 3). Individual smaller pockets of damage were located on the west side of Keppel Township, with one extending into Amabel Township, into Sullivan Township southwest of Chatsworth, and between highways 6 and 10 in Holland Township. Small numbers of larvae were observed at numerous other locations in the region.

Table 3. Summary of gypsy moth egg-mass survey results at 13 locations in the Southwestern Region of Ontario in 1989.

Location	Stand composition	Line search — total no. of eggs	Modified Kaladar plot — egg masses/ha
Aylmer District			
John E. Pearce Prov. Pk	beech, maple	0	N/A
Port Burwell Prov. Pk	beech, maple, oak	0	N/A
Chatham District			
Holiday Beach Conserv. Area	maple, pine	0	N/A
Ipperwash Prov. Pk	oak, poplar, birch	1	N/A
Moore Twp, Con.I	oak, hickory, beech	N/A	35,400
Pinery Prov. Pk	oak, pine, cherry	2	N/A
Point Pelee National Pk	hackberry, walnut	0[a]	N/A
Rondeau Prov. Pk	oak, cucumber	0	N/A
Wheatley Prov. Pk	oak, maple, hickory	N/A	16,700
Simcoe District			
Long Point Prov. Pk	cottonwood	1	N/A
Turkey Point Prov. Pk	oak, pine	N/A	52,300
Selkirk Prov. Pk	oak, hickory	1	N/A
Wingham District			
Point Farms Prov. Pk	cottonwood, ash birch	0	N/A

[a] Egg masses were found by park staff

In the Owen Sound District, egg-band counts for the purpose of forecasting infestation levels were carried out at 14 locations (Fig. 4). The results of these surveys indicate that the infestation will persist, and may also increase in size and intensity in 1990. Severe defoliation will probably be found in most areas that were heavily damaged in 1989 and may extend south of Chatsworth into Sullivan Township. Moderate defoliation is predicted for the south end of Sydenham Township; lighter damage may be expected in Glenelg Township, and east of the existing infestation in Euphrasia and Osprey townships (Table 4).

SOUTHWESTERN REGION

Figure 3. **Forest tent caterpillar, *Malacosoma disstria* (Hbn.)**

Areas within which moderate-to-severe defoliation occurred in 1989

⊠ or •

Forest Insect and Disease Survey
Forestry Canada, Ontario Region

SOUTHWESTERN REGION

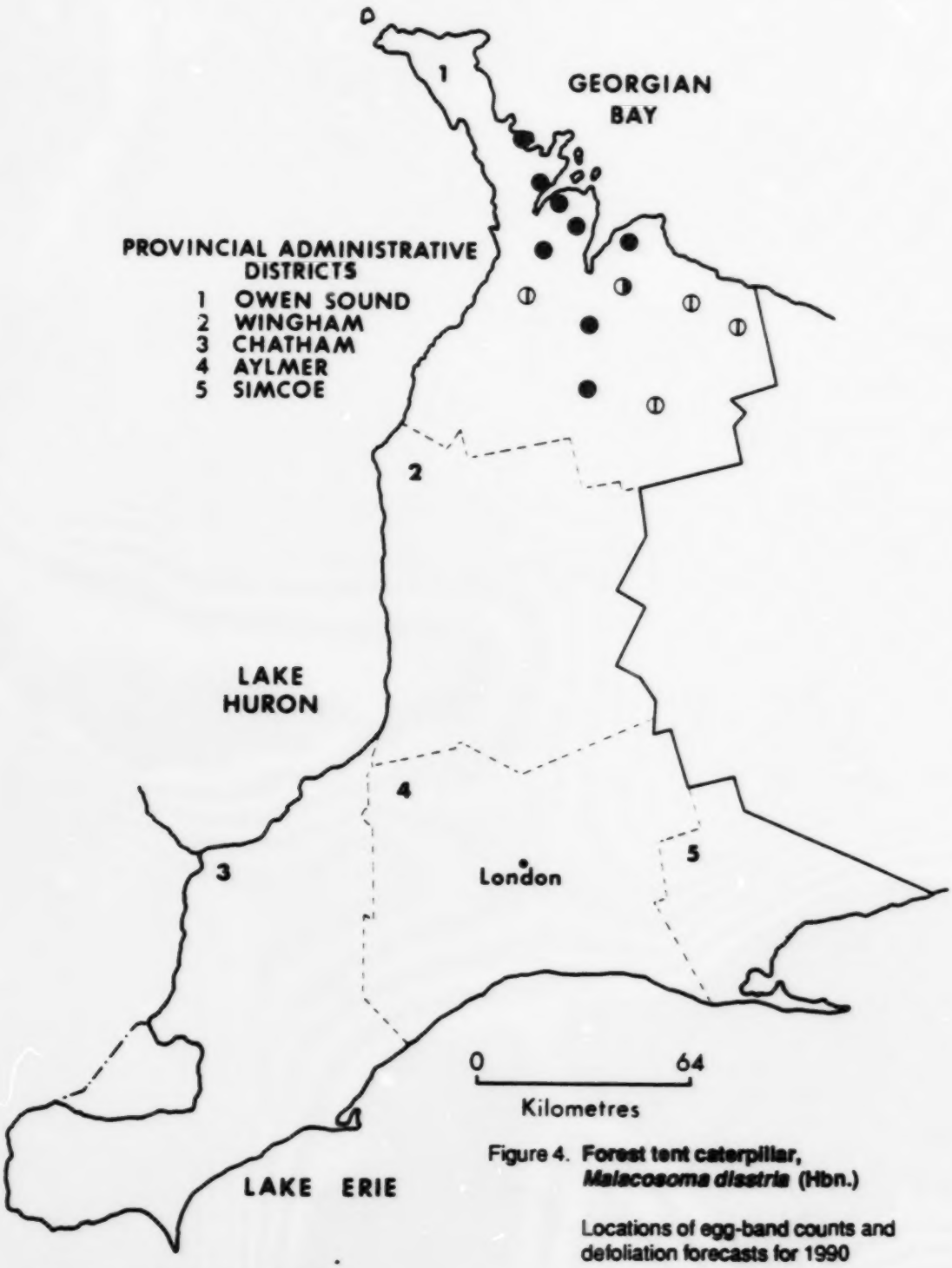

Figure 4. **Forest tent caterpillar, *Malacosoma disstria* (Hbn.)**

Locations of egg-band counts and defoliation forecasts for 1990

severe ..... ●
moderate ..... ◑
light ..... ◐

Forest Insect and Disease Survey
Forestry Canada, Ontario Region

Table 4. A summary of forest tent caterpillar egg-band counts at 14 locations in 1989 and infestation forecasts for 1990 in the Owen Sound District.

Location (Twp)	Host[a]	Avg DBH of trees (cm)	Avg no of egg bands per tree	Infestation forecast for 1990
Albemarle	tA	19	68	severe
Arran	tA	16	4	light
Eastnor	sM	16	76	severe
Euphrasia	sM	22	3	light
Glenelg	sM	18	2	light
Holland	sM	17	56	severe
Keppel Con. II	sM	19	80	severe
Keppel Con. XVI	sM	20	14	severe
Keppel Con. XXII	sM	18	75	severe
Osprey	sM	16	3	light
Sullivan Con. II	sM	18	30	severe
Sullivan Con. V	sM	20	32	severe
Sydenham Con. VI	sM	20	87	severe
Sydenham Con. VII	sM	17	6	moderate

[a] tA = trembling aspen, sM = sugar maple

European Pine Sawfly, *Neodiprion sertifer* (Geoff.)

A general increase in the populations of this pest of Scots pine (*Pinus sylvestris* L.) was evident in the Simcoe District in 1989. A 50-tree assessment in a 20-ha Christmas tree plantation was typical of those carried out on several sites in the district. The assessment revealed that 74% of the 1.4-m trees were infested with an average of two insect colonies per tree; there was up to 90% defoliation on some trees, and the average was 30% on infested trees throughout the plantation. Plantations ranging in size from 2 to 40 ha were lightly infested in Charlotteville, Walsingham, Windham, Middleton, Norwich and Burford townships, Simcoe District. Roadside and forest-edge trees sustained an average of 25% defoliation in the southern part of the district.

White Pine Weevil, *Pissodes strobi* (Peck)

The results of surveys at 14 locations in the Southwestern Region indicate decreased populations in 1989 on eastern white pine (Table 5). Of the 14 areas assessed, six were associated with the special survey of eastern white pine plantations. Weevil damage was encountered at six locations in 1989, in comparison with seven in 1988. The highest incidence of leader attack found in 1988 was 16.0% in North Walsingham Township, Simcoe District, whereas the 1989 survey revealed a high of only 4.7% damaged leaders in West Oxford Township, Aylmer District. The

general decline in populations is illustrated by the fact that nine areas were compared and, when the average was calculated, only 2% of the leaders were damaged in 1989 in comparison with 5.6% in 1988.

Table 5. Summary of damage caused by the white pine weevil at 14 locations in the Southwestern Region of Ontario in 1988 and 1989 (counts based on the examination of 150 randomly selected eastern white pine trees at each location).

Location (Twp)	Avg ht of trees (m)	Density (trees/ha)	Area affected (ha)	Leaders attacked (%)	
				1988	1989
Aylmer District					
Bayham	4.6	1415	2.5	0.0	0.0
Lobo	3.0	2375	0.6	0.0	0.0
Mosa	3.5	2320	1.0	0.0	0.0
W.Oxford	4.7	2990	3.0	14.0	4.7
Chatham District					
Zone	1.8	2990	0.8	1.0	0.0
Simcoe District					
Charlotteville	3.3	2900	1.6	8.0	4.0
Charlotteville	1.2	2990	1.5	2.0	2.7
N.Walsingham	7.1	1000	0.4	16.0	4.0
S.Walsingham	8.9	2990	3.0	7.0	0.0
Windham	3.7	1500	1.0	2.0	0.0
Wingham District					
Goderich	3.8	1780	0.6	0.0	0.0
Hullet	5.1	1200	50.0	0.0	0.0
Mornington	7.5	2990	3.3	0.0	0.7
Turnberry	4.3	2900	0.5	0.0	2.0

European Pine Shoot Moth, *Rhyacionia buoliana* (D.&S.)

Population levels were noted to be on the increase in the region in 1989. The most severe damage occurred in a 2-ha plantation of Scots pine Christmas trees in Charlotteville Township, Simcoe District, where 80% of the leaders were infested. The European pine shoot moth was also recorded in a number of other Christmas tree plantations; numerous laterals and, to a lesser extent, leaders were attacked. Control in many areas was achieved by clipping; however, in severe cases, chemical control was deemed necessary.

Minor Insects

Maple Webworm, *Tetralopha asperatella* (Clem.)

Maple webworm populations increased in 1989 in the Owen Sound District. The highest populations were predominantly in the same sugar maple stands previously damaged by the forest tent caterpillar. Most stands in Eastnor, Albemarle, Keppel, Sydenham and Euphrasia townships had 100% of their trees infested with high populations. Damage levels were difficult to estimate as the leaves had been defoliated previously by the forest tent caterpillar and the quantity of new foliage varied greatly among stands. Maple webworm larvae are known to feed on various hardwoods, primarily maples. The moths lay eggs from late June to late August on leaves partially rolled or damaged by other insects such as the forest tent caterpillar. The larvae feed for awhile on the site, and later web together and feed on the surrounding leaves. In this case the maple webworm is of particular importance because it feeds on remnant and second-growth leaves on trees that were damaged by other insects in the same season. This creates additional stress for the trees and may have an effect on tree growth. The larvae drop to the ground and spend the winter in a white silken cocoon in the soil, changing to a pupa early in spring.

Lower damage levels were also observed at many other sites in the district.

Table 6. Other Forest Insects

Insect	Host(s)	Remarks
Adelges abietis (L.) Eastern spruce gall adelgid	wS, nS	Large numbers on hedgerows caused 10% branch mortality at St. Williams Nursery in Charlotteville Twp, Simcoe District.
Cecidomyia verrucicola O.S. Linden wartgall midge	Ba	small numbers on roadside trees in Sombra Twp, Chatham District
Coleophora ostrayae Clem. Ironwood casebearer	shHi	Large populations caused 1% defoliation near Fishers Glen in Charlotteville Twp, Simcoe District.
Coleophora ulmifoliella McD. Elm casebearer	Elm	Foliar damage levels of 80% were recorded on 3-m trees in the Turkey Point Tract, Charlotteville Twp, Simcoe District.

(cont'd)

Table 6. Other Forest Insects

Insect	Host(s)	Remarks
Corthylus punctatissimus (Zimm.) Pitted ambrosia beetle	sM	Mortality levels of 10% and 30% were recorded on 0.5-m host trees at sites in Saugeen Twp, Owen Sound District and West Wawanosh Twp, Chatham District, respectively.
Cryptococcus fagisuga Linding. Beech scale	Be	Four locations in Aylmer and Simcoe districts were examined for the presence of the beech scale. All results were negative.
Datana integerrima G.& R. Walnut caterpillar	Bu, Wa	Increased populations caused 50-100% defoliation of scattered roadside and forest-edge trees averaging 7.8-m in height in the Simcoe and Aylmer districts.
Diapheromera femorata (Say) Walking stick	Deciduous	Small numbers were observed at Turkey Point Prov. Pk, Simcoe District and at Wheatley Prov. Pk, Chatham District.
Diprion similis (Htg.) Introduced pine sawfly	wP,rP	Less than 5% defoliation was recorded at two sites in Wingham and Simcoe districts.
Epinotia aceriella (Clem.) Maple trumpet skeletonizer	sM	Scattered host trees sustained 80% defoliation in Port Burwell Prov. Pk, Bayham Twp, Aylmer District.
Halysidota tessellaris (J.E.Smith) Pale tussock moth	Ba	Complete defoliation of 20% of the trees was recorded along a 1.5-km stretch of road in Sombra Twp, Chatham District.
Hyphantria cunea (Drury) Fall webworm	Deciduous	Conspicuous tents were recorded at many sites in the region. Defoliation averaged <30% in all areas.

(cont'd)

Table 6. Other Forest Insects (concl.)

Insect	Host(s)	Remarks
Lepidosaphes ulmi (L.) Oystershell scale	Ho	Heavy infestation of 2% of the trees resulted in complete leaf discoloration and defoliation in a 0.1-ha plantation in Zone Twp, Chatham District.
Malacosoma americanum (F.) Eastern tent caterpillar	chCh, wB	complete defoliation of host trees at many locations throughout the region
Neodiprion pinetum (Nort.) White pine sawfly	wP	5% defoliation of 3-m trees in Blandford Twp, Aylmer District
Pseudexentera oregonana (Wlsm.) Early aspen leafcurler	tA	80% defoliation of 65% of the 5-m trees in a 1.5-ha area in North Easthope Twp, Wingham District

Mature larva of the forest tent caterpillar, *Malacosoma disstria* (Hbn.), on a sugar maple (*Acer saccharum* Marsh.) leaf

TREE DISEASES

Major Diseases

Scleroderris Canker, *Ascocalyx abietina* (Lagerb.) Schläpfer-Bernhard

In all, 22 red pine (*Pinus resinosa* Ait.) and Scots pine plantations in the region were examined for the presence of this disease (Fig. 5). There was no sign of Scleroderris canker at any of the locations surveyed. Various other types of damage, such as juglone toxicity, Armillaria root rot (*Armillaria ostoyae* [Romagn.] Herink.), root collar weevils, porcupines, lightning strikes and bark beetles, were found to be as factors contributing to pine mortality. Some of these factors may have been precipitated by drought stress in 1988.

Tip Blight, *Sphaeropsis sapinea* (Fr.) Dyko & B. Sutton

This fungus, which causes tip blight and dieback of native pines and the exotic species Scots pine and Austrian pine (*Pinus nigra* Arnold), continues to be the cause of significant damage in parts of the South-western Region.

Branch mortality was observed on 3% of the 3-m red pine in a 2-ha plantation in West Oxford Township, Aylmer District, and various amounts of top mortality were found on some trees. Extensive branch mortality was recorded on Mugho pine (*P. mugo* Turra var. *mughus* Zenari) at the Townsend Centre municipal office, Townsend Township, Simcoe District. Assessment of the total accumulated damage was not possible because of the constant sanitation efforts by the Townsend Centre staff. Lower levels of branch and whole-tree mortality on ornamental Scots and Austrian pine were recorded along urban roadways in Tillsonburg and London, Aylmer District and in Delhi and Simcoe, Simcoe District.

Table 7. Other Forest Diseases

Organism	Host(s)	Remarks
Asteroma caryae (Peck) B. Sutton Leaf spot of hickory	sHi	Foliar damage averaged 20% in 2- to 15-ha hickory woodlots in the Chatham, Aylmer and Simcoe districts.
Ceratocystis ulmi (Buism.) C. Moreau Dutch elm disease	wE	Mortality amounting to 6% was recorded on 7-m roadside trees and 9.3% of elms suffered infection in Raleigh Twp, Chatham District. This was typical of conditions throughout the region.

(cont'd)

Table 7. Other Forest Diseases (cont'd)

Organism	Host(s)	Remarks
Cronartium ribicola J.C. Fischer White pine blister rust	wP	light main-stem infections on 20-m trees in Windham Twp, Simcoe District
Discula sp. Anthracnose	wAsh, Be	Ornamental trees throughout the region suffered 100% leaf infection, and this resulted in premature leaf drop.
Discula platani (Peck) Sacc. Anthracnose	Sy	varying levels (20-85%) of leaf infection and subsequent defoliation through Aylmer, Wingham and Simcoe districts
Marssonina brunnea (Ell.& Ev.) Magnus Marssonina leaf spot	tA	Leaf infection averaged 70% in a 0.5-ha area at two widely separated sites in Chatham and Simcoe districts.
Melampsora abietis-canadensis C.A. Ludwig ex Arthur Hemlock-poplar rust	eH	60% of the cones infected in a 10-ha woodlot in Dereham Twp, Aylmer District
Meloderma desmazierii (Duby) Darker Needle cast	scP	Foliar damage averaged 75% on 6.7% of the 1.5-m trees in a 1-ha plantation in Turnberry Twp, Wingham District.
Melanconis juglandis (Ell.& Ev.) Graves Melanconis canker	Bu	This is a secondary fungus that often colonizes tissue weakened by butternut canker (*Sirococcus clavigignenti-juglandacearum* Nair, Kostichka & Kuhtz). It was isolated from two of five samples that proved negative for butternut canker. Branch mortality totalled 5% on single trees in Charlotteville and S. Walsingham twp, Simcoe District.

(cont'd)

Table 7. Other Forest Diseases (concl.)

Organism	Host(s)	Remarks
Microstroma juglandis (Bereng.) Sacc. White mold	shHi, sHi	50% of expanding foliage affected at one location in the Simcoe District
Phyllosticta sphaeropsoidea Ell. & Ev Leaf blotch	hoCh	Foliar damage averaged 95% on ornamental host trees in the Simcoe District
Rhytisma punctatum (Pers.) Fr. Speckled tar spot	sM	Complete leaf defoliation occurred in a 0.5-ha area in Stephens Twp, Wingham District.
Tubakia dryina (Sacc.) B.Sutton Leaf spot	blO	100% defoliation of several trees in the town of Norwich, Norwich Twp, Simcoe District

ABIOTIC DAMAGE

Leaf Scorch

This condition results when hot, dry winds occur, causing rapid loss of water from the leaves. In 1989, this water could be replenished by the feeder roots because the moisture content of the soil remained low during droughtlike conditions experienced in some parts of the region.

Dead, brownish leaf margins were observed on 70-100% of the foliage of sugar maple and other roadside planted maples in the Wingham District and the eastern part of Simcoe District. Damage was most severe on these roadside trees, probably because they were growing on such exposed sites. A singular roadside evaluation was typical of those made throughout the region, where 11-m sugar maple trees sustained on average of 85% foliar damage followed by premature leaf drop.

Physiological Needle Droop

A needle droop condition caused serious damage to a number of eastern white pine plantations in the Southwestern Region.

The most severly affected area was a 1.0-ha eastern white pine plantation in Windham Township, Simcoe District, where 52.5% of the foliage was affected on 89.3% of the 3.7-m trees. The incidence ranged from 31.3% to 89.3% and foliar damage averaged 40% in plantations. This was typical of conditions across the region in Owen Sound, Chatham, Aylmer and Simcoe districts.

SOUTHWESTERN REGION

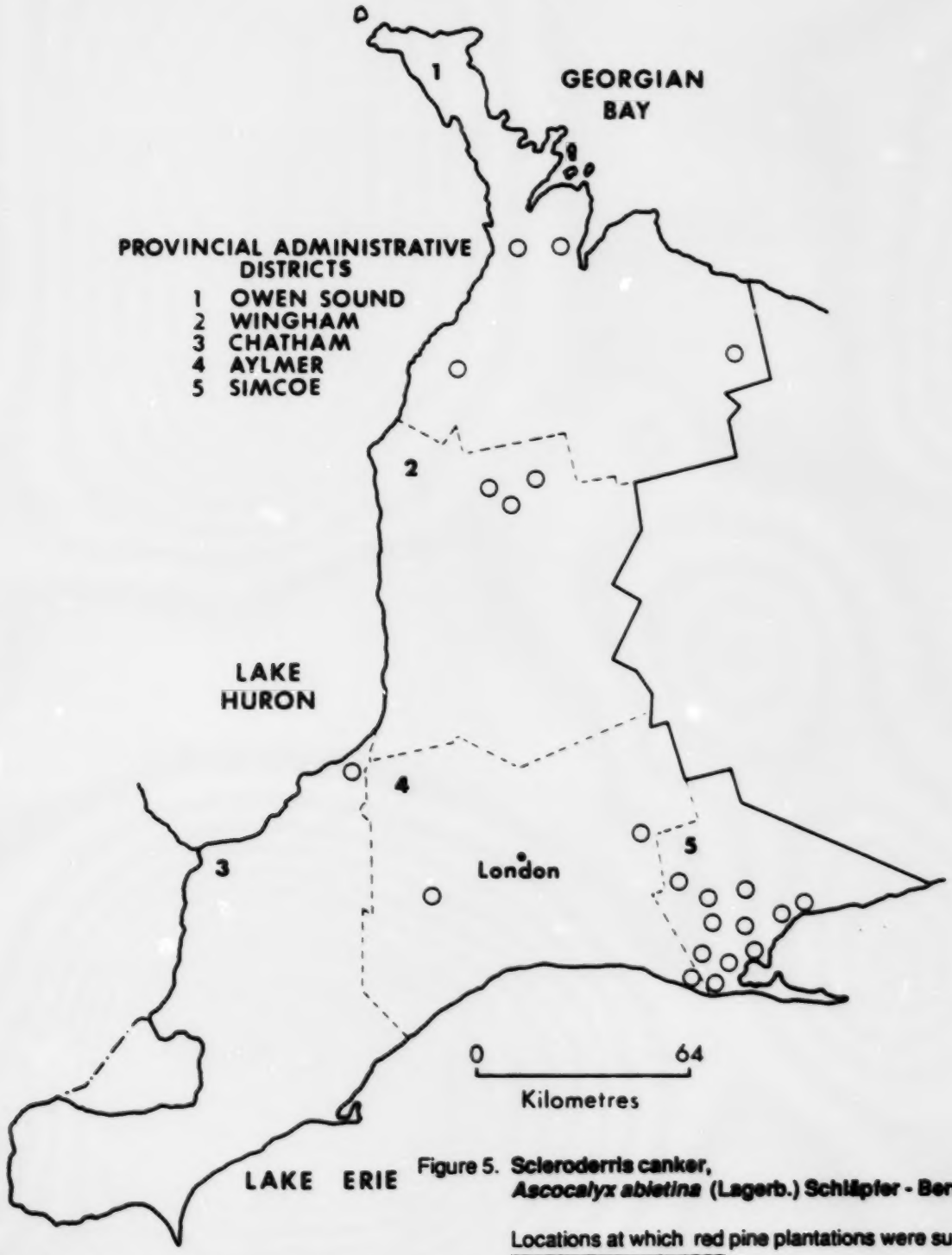

Figure 5. **Scleroderris canker, *Ascocalyx abietina* (Lagerb.) Schläpfer - Bernhard**

Locations at which red pine plantations were surveyed for this disease in 1989

negative ..... ○

Forest Insect and Disease Survey
Forestry Canada, Ontario Region

Surveys revealed abnormal drooping of the current season's needles. This was caused by sudden and excessively rapid transpiration, which resulted in an absorption lag, loss of turgor, and necrosis in the highly succulent young tissue at the needle base. The condition became apparent in the latter part of August.

Table 8. Other abiotic conditions.

Pest	Species affected	Remarks
Drought	wB,sM,wP	Yellow and wilting foliage was conspicuous on scattered deciduous trees growing on rocky sites and ridge tops in two 1-ha areas in Albemarle Twp, Owen Sound District. Up to 40% of the eastern white pine foliage was affected in plantations <2 ha in area on sandy sites in the southern parts of Aylmer, Chatham and Simcoe districts.

[a]wB = white birch, sM = sugar maple, wP = white pine

FOREST HEALTH

Oak Health

Three oak health plots were evaluated for the 13th consecutive year in the Southwestern Region and the data for the past three years are summarized in Table 9. A standard classification system is used to record the current and cumulative dieback levels in each crown. The first two classification categories are considered to represent light dieback and may be normal in forest stands.

In the oak plot in Bosanquet Township, Chatham District there were only minor changes in crown condition for most catagories. An additional five trees died, for a total of 12 in the plot. Of these dead trees, one was wind-snapped 4 m above ground; the cause of death could not be determined in another; and the remaining three, being suppressed trees in the stand, are believed to have succumbed to competition.

In the Simcoe District, assessment of the oak plot in Charlotteville Township revealed a considerable increase in crown dieback, with 37% of the trees in the second cumulative dieback category in 1989 in comparison with 8% in 1988. Tree mortality increased by 2% and this was attributed to breakage at cankered spots on the main stem. All trees on the plot were defoliated by gypsy moth, with damage levels averaging 16.5%. In the South Walsingham Township plot, 110 trees were evaluated and there were some changes in the overall crown condition, as well as

Table 9. Summary of oak health at three locations in the Southwestern Region of Ontario from 1987 to 1989.

	Avg DBH[a] (cm)	No. of trees examined	Year	Current dieback[b]						Cumulative dieback[b]						Trees blown down or cut
				0	1	2	3	4	5	0	1	2	3	4	5	
				No. of trees												
Chatham District																
Bosanquet Twp	29	100	1987	92	1	0	0	1	6	75	14	0	1	4	6	0
			1988	88	5	0	0	1	6	74	12	0	2	4	7	1
			1989	89	5	1	0	0	5	50	29	7	1	1	11	1
Simcoe District																
Charlotteville Twp	32	101	1987	94	5	0	0	0	2	35	57	4	2	1	2	0
			1988	85	13	1	0	0	2	42	47	8	1	1	2	0
			1989	14	71	10	1	0	4	3	54	37	1	1	4	1
South Walsingham Twp	22	110	1987	98	1	0	0	0	11	81	17	1	0	0	11	0
			1988	96	1	1	0	1	11	82	13	3	0	1	11	0
			1989	71	20	1	0	6	11	54	29	9	0	6	11	1

[a] from 1977 measurements

[b] 0 = 0-5%, 1 = 6-20%, 2 = 21-40%, 3 = 41-60%, 4 = 61-100%, 5 = dead tree

increases in the percentage of dead crown and mortality. Average defoliation levels of 35% were observed on plot trees as a result of gypsy moth feeding.

Maple Health

As part of a continuing commitment on the part of Forestry Canada to respond to growing concern about the health of maple trees, 10 study plots established in 1987 were reexamined in 1989 and an additional five rural roadside and five urban study plots were established (Fig. 6). The purpose of the program is to assess, monitor and compare maple trees growing under different conditions, i.e., in woodlots, or in urban or rural locations. The trees are assessed on an annual basis for current and cumulative crown deterioration. The presence of all significant biotic and abiotic forest pests is noted, and any other types of stress that may affect tree growth and overall health are recorded.

In the 10 woodlot study plots (Table 10) there has been no significant change in the current or cumulative crown condition. The only notable changes in 1989 were in West Oxford Township, Aylmer District, where one tree died for no apparent reason and another tree was cut and removed. In the Plympton Township plot, Chatham District one tree with two stem cankers moved into the 41-60% class. In Warwick Township, Chatham District one tree was cut and removed and another had a broken crown and was considered dead.

A summary of tree health in the newly established urban and rural plots is presented in Table 11. The most severe damage was recorded in the Wingham District plots, in which the maples were considerably less than healthy in appearance (Frontispiece). In all the plots examined only 71% of the trees fell into the 0-20% dieback class; the other 29% had serious dieback problems and were placed in higher dieback classes. Of these, the plot on Regional Road 13 in Goderich Township had the most severe damage, with 48% of the trees experiencing serious dieback. In Aylmer District, 96% of the trees evaluated were still within the 0-20% dieback range. The only exceptions were a single dead tree and two trees in the 21-40% dieback class in the town of Woodstock. In Simcoe District, 90% of the trees examined had cumulative crown dieback in the 0-20% range. The exceptions were found in the town of Norwich and in a rural plot in South Walsingham Township, where more trees were observed in higher dieback ranges (Table 11).

Cumulative dieback levels in plots established in woodlots and in urban/rural plots differ greatly (see Table 12). The most severe damage was recorded in the urban and rural plots because of predisposing factors such as poor site. In the 10 urban and rural plots established in 1989, 84.4% of the trees were recorded in the 0-20% dieback range and 8.8% were recorded in the 21-40% crown dieback range. In contrast, a 97.2% dieback level and a 0.4% crown dieback level were recorded in the woodlot plots.

SOUTHWESTERN REGION

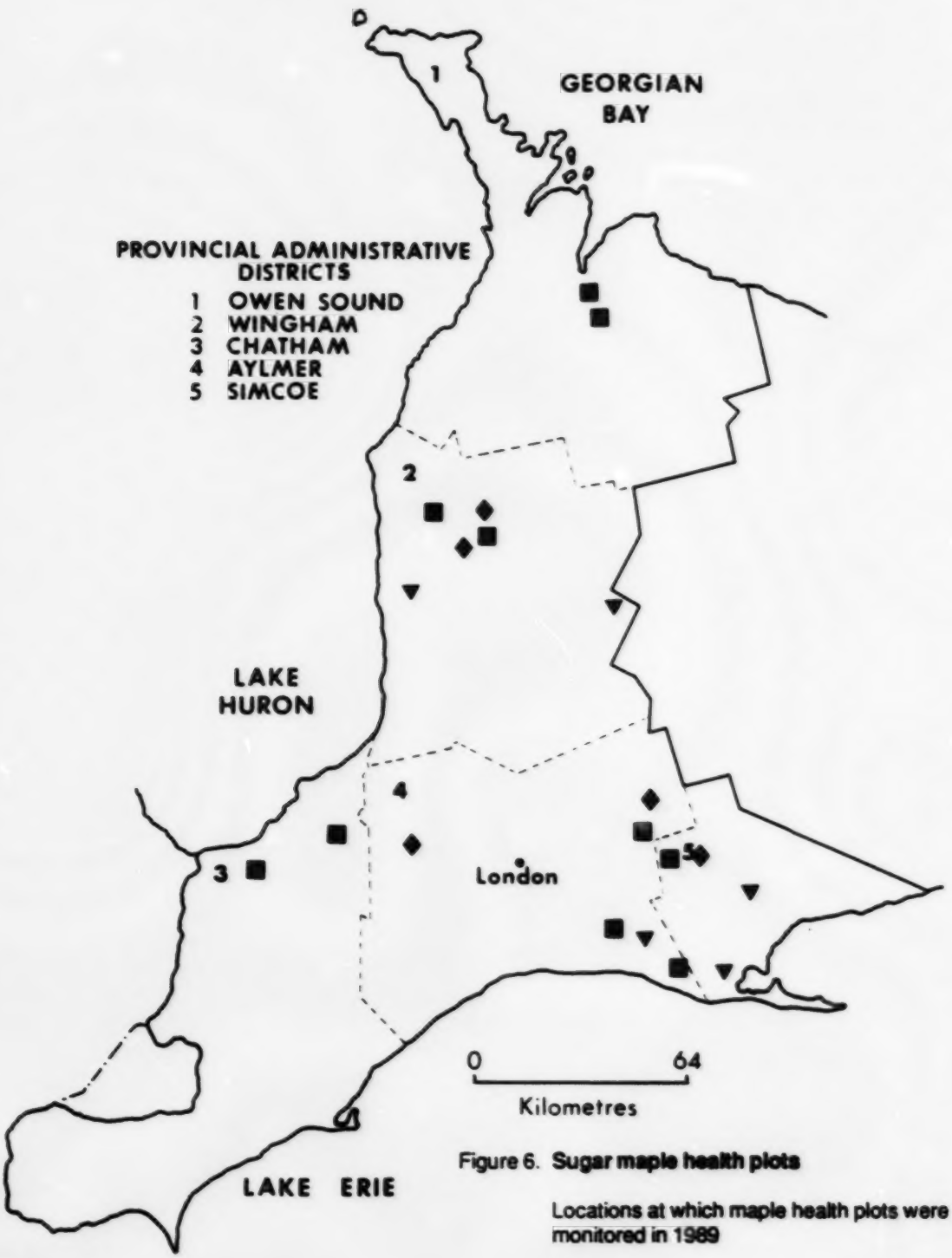

Figure 6. **Sugar maple health plots**

Locations at which maple health plots were monitored in 1989

Urban roadside .....
Rural roadside .....
Woodlot .....

Forest Insect and Disease Survey
Forestry Canada, Ontario Region

Table 10. Summary of maple health at 10 woodlot locations in the Southwestern Region of Ontario from 1987 to 1989 (25 maple trees examined at each location).

Location (Twp)	Avg DBH (cm)	Avg height (m)	Year	Current dieback[a]						Cumulative dieback[a]						Trees blown down or cut
				0	1	2	3	4	5	0	1	2	3	4	5	
				-	-	-	-	-	No. of trees -	-	-	-	-	-	-	
Aylmer District																
Malahide	35.3	22	1987	25	0	0	0	0	0	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	25	0	0	0	0	0	0
			1989	24	1	0	0	0	0	24	1	0	0	0	0	0
West Oxford	27.1	21	1987	25	0	0	0	0	0	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	25	0	0	0	0	0	0
			1989	22	1	0	0	0	1	22	1	0	0	0	1	1
Chatham District																
Plympton	29.3	22	1987	25	0	0	0	0	0	24	1	0	0	0	0	0
			1988	24	1	0	0	0	0	23	2	0	0	0	0	0
			1989	23	1	1	0	0	0	23	0	1	1	0	0	0
Warwick	31.3	27	1987	24	1	0	0	0	0	24	1	0	0	0	0	0
			1988	22	1	0	0	1	0	22	1	0	0	1	0	1
			1989	21	1	0	1	0	1	21	1	0	0	1	1	1
Owen Sound District																
Derby	31.6	24	1987	25	0	0	0	0	0	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	25	0	0	0	0	0	0
			1989	25	0	0	0	0	0	25	0	0	0	0	0	0
Sullivan	42.2	26	1987	25	0	0	0	0	0	25	0	0	0	0	0	0
			1988	24	1	0	0	0	0	24	1	0	0	0	0	0
			1989	25	0	0	0	0	0	24	1	0	0	0	0	0

[a] 0 = 0-5%, 1 = 6-20%, 2 = 21-40%, 3 = 41-60%, 4 = ≥61%, 5 = dead tree

(cont'd)

Table 10. Summary of maple health at 10 woodlot locations in the Southwestern Region of Ontario from 1987 to 1989 (25 maple trees examined at each location) (concl.).

Location (Twp)	Avg DBH (cm)	Avg height (m)	Year	Current dieback[a]						Cumulative dieback[a]						Trees blown down or cut
				0	1	2	3	4	5	0	1	2	3	4	5	
				-	-	-	-	-	No. of trees	-	-	-	-	-	-	
Simcoe District																
Houghton	33.3	24	1987	25	0	0	0	0	0	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	25	0	0	0	0	0	0
			1989	25	0	0	0	0	0	25	0	0	0	0	0	0
N. Norwich	31.0	21	1987	25	0	0	0	0	0	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	25	0	0	0	0	0	0
			1989	25	0	0	0	0	0	25	0	0	0	0	0	0
Wingham District																
Morris	29.5	21	1987	25	0	0	0	0	0	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	25	0	0	0	0	0	0
			1989	25	0	0	0	0	0	24	1	0	0	0	0	0
W. Wawanosh	30.3	21	1987	25	0	0	0	0	0	25	0	0	0	0	0	0
			1988	25	0	0	0	0	0	25	0	0	0	0	0	0
			1989	24	1	0	0	0	0	24	1	0	0	0	0	0

[a] - 0 = 0-5%, 1 = 6-20%, 2 = 21-40%, 3 = 41-60%, 4 = ≥61%, 5 = dead tree

Table 11. Summary of maple health at 10 urban and rural locations in the Southwestern Region of Ontario in 1989 (25 roadside maple trees examined at each location).

Location	Plot type[a]	Avg DBH (cm)	Avg height (m)	Current dieback[b]						Cumulative dieback[b]						Trees blown down or cut
				0	1	2	3	4	5	0	1	2	3	4	5	
				-	-	-	-	-	No. of trees	-	-	-	-	-	-	
Aylmer district																
Bayham Twp	R	85.9	20	23	2	0	0	0	0	23	2	0	0	0	0	0
Strathroy	U	82.5	24	24	1	0	0	0	0	21	4	0	0	0	0	0
Woodstock	U	65.7	23	22	1	1	0	0	1	20	2	2	0	0	1	0
Simcoe District																
Norwich	U	60.8	16	18	3	4	0	0	0	17	4	3	0	1	0	0
S. Walsingham Twp	R	62.6	20	20	5	0	0	0	0	18	4	2	1	0	0	0
Windham Twp	R	81.9	23	23	2	0	0	0	0	22	3	0	0	0	0	0
Wingham District																
Blyth	U	74.3	23	19	3	3	0	0	0	14	5	4	2	0	0	0
Goderich Twp	R	72.4	19	13	7	4	1	0	0	9	4	6	4	2	0	0
N. Easthope Twp	R	69.2	18	4	17	3	1	0	0	4	12	5	2	2	0	0
Wingham	U	68.0	21	23	0	2	0	0	0	20	3	0	1	1	0	0

[a] R = rural, U = urban

[b] 0 = 0-5%, 1 = 6-20%, 2 = 21-40%, 3 = 41-60%, 4 = ≥61%, 5 = dead tree

The health of maples in Wingham District has been a concern for some time. Results of surveys carried out in 1982 on urban and rural roadside trees, when compared with those of surveys carried out in 1989, indicate similar crown conditions (Table 12). The reasons for the similarities are unclear; however, this does suggest that roadside maples in the Wingham District have been in poor health for many years. Causal factors may include exposure to spray from deicing salts, increasing soil salinity and roadside disturbances, e.g., ditching, widening, root compaction, and roadside herbicide applications. No recent insect or disease outbreak has been recorded on roadside trees; however, six severe attacks of anthracnose, as well as scorch and frost damage, have been recorded in the past 10 years affecting roadside trees in the Wingham District.

North American Maple Project

The North American Maple Project is a 3-year cooperative study begun in 1988 by Forestry Canada and the United States Forest Service. The main objectives of the project are: to determine the rate of change in the condition of sugar maple trees; to determine if the rate of change differs a) according to the level of pollution, b) between sugarbushes and undisturbed forests, and c) among various levels of initial stand decline; and to determine the possible causes of sugar maple decline in various geographical areas.

In Ontario, the Forest Insect and Disease Survey Unit was responsible for the establishment and annual assessments of plots. In all, 24 plots were established across the range of sugar maple in Ontario, seven of them in the Southwestern Region. Baseline data were recorded for all sugar maples on the plots: tree diameters, crown position and vigor, tapping records, stem defects, percentage of crown dieback, foliar density and leaf discoloration and dwarfing. Increment cores were used to determine stand age and to evaluate growth patterns prior to plot establishment.

In 1989, observations of crown condition indicated that, in six of the seven plots, over 92% of the trees evaluated had <15% crown dieback, which is considered to be normal and can be expected in a healthy stand (Table 13). In the remaining plot currently being tapped for maple syrup in Townsend Township, Simcoe District, 29% of the trees had more than 16% of their crown dead. The crown dieback condition recorded in 1989 is not much different from that which was tallied at plot establishment in 1988. Some of the trees appear overmature; tapping for maple syrup and drought-like conditions experienced in 1988 may be additional stresses that reflect crown condition in this plot.

Table 12. A comparison of cumulative crown dieback in woodlot and urban and rural roadside maple health study plots in the Southwestern Region of Ontario in 1982 and 1989.

Location	Avg DBH (cm)	No. of plots	Year	Cumulative dieback[a] (% of trees examined)					Trees blown down or cut (%)
				1	2	3	4	5	
Wingham: urban/rural roadside	36.2	3	1982	60.2	19.8	10.7	7.3	2.0	0.0
Wingham: urban/rural roadside	70.9	4	1989	71.0	15.0	9.0	5.0	0.0	0.0
Region: urban/rural roadside	72.3	10	1989	84.4	8.8	4.0	2.4	0.4	0.0
Region: woodlots	32.1	10	1989	97.2	0.4	0.4	0.4	0.8	0.8

[a] 1 = 0-20%, 2 = 21-40%, 3 = 41-60%, 4 = ≥61%, 5 = dead tree

Table 13. Summary of the crown condition of sugar maple at seven North American Maple Project plots in the Southwestern Region in 1988 and 1989.

Location (Twp)	Avg DBH (cm)	Year	No. of trees examined	Total percentage of dead crown											Trees dead	Trees blown down or cut
				0	1-5	6-15	16-25	26-35	36-45	46-55	56-65	66-75	76-85	86-95	96-100	
				No. of trees												
Chatham District																
Warwick[a]	26.5	1988	48	38	9	0	1	0	0	0	0	0	0	0	0	0
		1989	47	20	27	0	0	0	0	0	0	0	0	0	1	0
Aylmer District																
Blandford[a]	29.6	1988	42	36	6	0	0	0	0	0	0	0	0	0	0	0
		1989	42	21	21	0	0	0	0	0	0	0	0	0	0	0
Bayham[b]	41.4	1988	39	13	22	1	1	1	0	0	0	0	0	0	0	0
		1989	38	17	18	0	2	1	0	0	0	0	0	1	1	0
Wingham District																
W. Wawanosh[a]	29.9	1988	36	14	20	2	0	0	0	0	0	0	0	0	0	0
		1989	36	9	26	1	0	0	0	0	0	0	0	0	0	0
Goderich[b]	32.3	1988	61	22	30	6	1	0	0	1	0	0	0	1	0	0
		1989	59	16	36	3	2	2	0	0	0	0	0	0	1	1
Simcoe District																
Townsend[b]	41.1	1988	32	15	8	3	2	2	1	0	1	0	0	0	0	0
		1989	32	14	9	3	1	2	1	0	1	0	1	0	0	0
Owen Sound District																
Saugeen[b]	30.8	1988	38	12	24	1	1	0	0	0	0	0	0	0	0	0
		1989	38	5	26	4	2	1	0	0	0	0	0	0	0	0

[a] undisturbed woodlot
[b] trees currently tapped for maple syrup

SPECIAL SURVEYS

Eastern White Pine Plantations

For the fourth time in nine years eastern white pine was selected as the host tree for a special pest survey in the Southwestern Region. Results obtained from eight locations across five districts in 1989 are summarized in Table 14, and reveal that no single insect or disease had a significant impact on trees. A physiological needle droop was found affecting as many as 89.3% of the trees in five of the eight plantations in Windham Township, Simcoe District, and the highest foliar damage level (65.0%) was recorded in Zone Township, Chatham District. In all other plantations with needle droop, lighter foliar damage and a lower incidence of trees affected were recorded. The cause and effect of physiological needle droop of pine were previously described in this report under **Abiotic Damage**. Pine spittlebug, (*Aphrophora cribrata* (Wlk.), and pine bark adelgid, (*Pineus strobi* (Htg.), were both recorded on 100% of the trees in the plantation in South Walsingham Township, Simcoe District; however, there was no visible damage, as population levels were very low.

Not included in the table are data on the gypsy moth, which caused on average of <1% defoliation on 87.7% of the trees in the South Walsingham Township plantation in Simcoe District. Other major forest pests that this survey was specifically designed to monitor but were not encountered include the eastern pine shoot borer, *Eucosma gloriola* Heinr. and Armillaria root rot.

Prior to the current survey, the white pine weevil was the only pest that caused significant damage. In 1980, in four of the seven plantations examined, an average of 5.1% of the trees had damaged terminals. In 1983, 2.7% terminal damage was recorded in three of the six plantations, whereas in 1986, when white pine weevil populations declined, only 2% damage was recorded in one of the seven plantations. Weevil populations continued to decline, and in 1989 damage levels averaged 1.6% in three of the eight plantations in which this survey was conducted. The results of past surveys reveal that no other major forest pest has caused significant damage to eastern white pine plantations in the region, although there have been records of sporadic localized injury caused by other insect and disease organisms.

Eastern White Pine Cone and Seed Pests

In 1989, 100 green second-year cones were collected from 16-m eastern white pine trees on the Turkey Point Tract in Charlotteville Township, Simcoe District. The cone collection was made before 15 July so that as many as possible of the causal agents involved in seed loss within cones could be recovered. Of the cones examined, 35% were damaged, and a 52.1% seed loss resulted. The most serious causal agent found was the white pine cone borer, *Eucosma tocullionana* Heinr., which accounted for 58.7% of the total seed loss; it was followed by the white pine cone beetle, *Conophthorous coniperda* (Schw.), which caused 20.2%

Table 14. Summary of the results of an eastern white pine plantation survey conducted at eight locations in the Southwestern Region of Ontario in 1989 (counts based on the examination of 150 randomly selected trees at each location).

Location (Twp)	Avg tree ht (m)	Density (trees/ha)	Stand size (ha)	Pine spittlebug	White pine weevil	Pine bark adelgid	White pine blister rust	Physiological needle droop	
				trees infested (%)	leaders attacked (%)	trees attacked (%)	trees affected (%)	trees affected (%)	foliar damage (%)
Aylmer District									
Lobo	3.0	2375	0.6	0.0	0.0	0.0	0.0	68.7	37.5
Chatham District									
Zone	1.8	2990	0.8	0.0	0.0	0.0	0.0	52.0	65.0
Owen Sound District									
Glenelg	3.5	4200	1.0	0.0	2.0	0.0	1.3	0.0	0.0
Saugeen	3.5	4000	3.0	0.0	0.0	0.0	0.0	0.0	0.0
Simcoe District									
Charlotteville	1.2	2990	1.5	2.3	2.7	0.0	0.0	31.3	5.0
S. Walsingham	8.9	2990	3.0	100.0	0.0	100.0	0.0	0.0	0.0
Windham	3.7	1500	1.0	0.0	0.0	0.0	0.0	89.3	52.5
Wingham District									
Mornington	7.5	2990	3.3	0.7	0.7	0.0	0.0	0.7	3.0

loss. The remaining seed loss was caused by a cone midge, *Resseliella* sp. (11.1%), and by unknown pests (10.0%).

A 1986 survey for cone pests of eastern white pine revealed that the white pine cone borer was responsible for 97.7% of seed loss. It was followed by the cone midge, which caused 2.3% of the damage. No disease organisms were recorded on eastern white pine cones in either survey.

Pear Thrips, *Taeniothrips inconsequens* (Uzel)

A special survey to detect pear thrips on sugar maple in Ontario was initiated in 1989. The pear thrips is an economically important pest of many plants, particularly of fruit trees, and has recently become a serious pest of sugar maple in the northeastern United States, especially in New York, Pennsylvania, Vermont, and parts of Massachussetts and New Hampshire. Foliar damage is caused when the thrips feeds with its sharp, needlelike mouth parts on liquids in the tender plant tissue. Damage by the pear thrips includes fallen green leaves, leaves smaller than normal, chlorotic and tattered leaves, leaf margins brown or wilted, and leaves puckered or wrinkled. The damage may be confused with frost and anthracnose damage. In areas of the United States in which outbreaks of pear thrips have persisted, growth decline and crown dieback have occurred.

The pear thrips spends the winter in the soil as a pupa, and early in the spring the winged adult thrips emerges from the ground. It migrates to feed on expanding buds, and at this time extensive damage can be inflicted on the tender, developing foliage. The adults lay their eggs at oviposition sites in the leaf petiole and main veins, leaving brown scars. The nymphs soon hatch, feed on developing leaves and drop to the ground, where they pupate and overwinter.

Surveys for the pear thrips in the Southwestern Region included the collection of expanding sugar maple buds and flowers at 11 different sites in early May (Fig. 7). These collections were submitted for examination and pear thrips adults were found in the samples from Holland and Amabel townships, Owen Sound District and Goderich Township, Wingham District. The pear thrips was not found in the remaining eight collections. Foliar damage was not observed at either of the positive sites in Wingham and Owen Sound districts.

Acid Rain National Early Warning System (ARNEWS)

An annual assessment was conducted in the three ARNEWS plots. Branch, crown and tree condition were monitored and the presence of any damage by insects, diseases, or abiotic factors was recorded. Table 15 summarizes the cumulative tree crown condition for all years of the study. In 1989, the most significant factor affecting tree condition was recorded in the South Walsingham Township plot in Simcoe District, where defoliation by the gypsy moth ranged from 15% on black cherry (*Prunus*

SOUTHWESTERN REGION

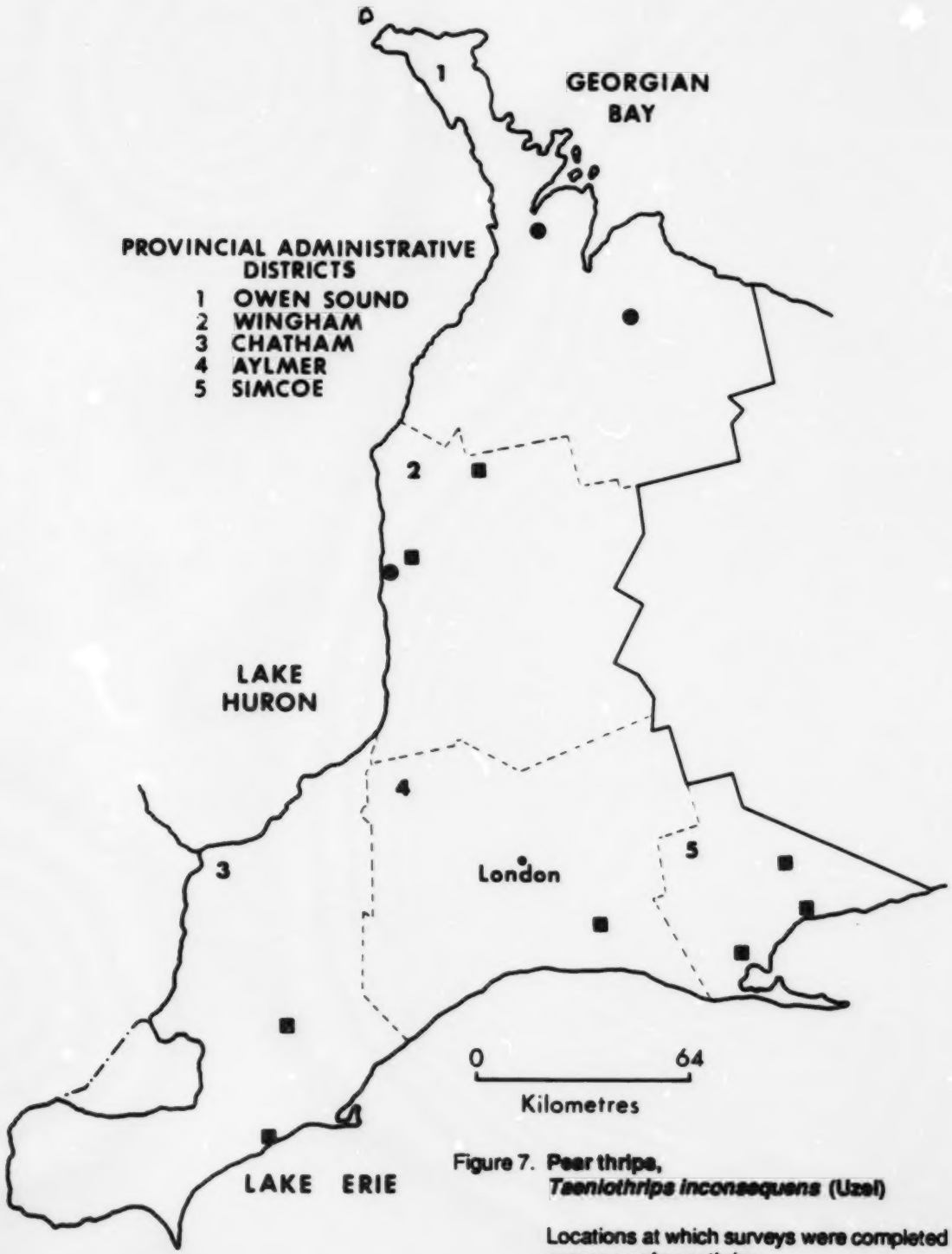

Figure 7. **Pear thrips,**
***Taeniothrips inconsequens* (Uzel)**

Locations at which surveys were completed for presence of pear thrips.

positive ..... ●
negative ..... ■

Forest Insect and Disease Survey
Forestry Canada, Ontario Region

Table 15. Summary of hardwood health at three Acid Rain National Early Warning System plots established in the Southwestern Region of Ontario.

Location (Twp)	Tree species	No. of trees examined	Avg DBH (cm)	Year	Tree crown condition[a]								
					1	2	3	4	5	6	7	8	9
					No. of trees								
District													
Howard	sM	9	36.3	1985	3	0	0	6	0	0	0	0	0
				1986	3	0	0	6	0	0	0	0	0
				1987	3	0	0	6	0	0	0	0	0
				1988	2	0	5	2	0	0	0	0	0
				1989	2	0	4	3	0	0	0	0	0
Simcoe District													
S. Walsingham	Oak	16	27.8	1986	1	0	4	7	4	0	0	0	0
				1987	0	0	2	12	2	0	0	0	0
				1988	1	0	3	11	1	0	0	0	0
				1989	0	0	3	13	0	0	0	0	0
Wingham District													
W. Wawanosh	sM	15	41.1	1985	7	0	0	7	0	0	0	0	1
				1986	7	0	0	7	0	0	0	0	1
				1987	6	0	0	7	0	1	0	0	1
				1988	6	0	4	3	0	0	1	0	1
				1989	5	1	3	4	0	0	0	1	1

[a] Crown classes:
1 = normal healthy tree
2 = foliage thin, off-color, particularly in upper crown; no bare twigs or branches
3 = dead twigs present but no dead branches (Dead twigs occur at the ends of branches, usually at the top of the crown and for a distance of about 0.5 to 1.0 m from the edge of the crown.)
4 = dead branches present on up to 25% of the crown
5 = dead branches present on up to 50% of the crown
6 = >50% of the crown dead but some living branches still present on the tree
7 = >50% of the crown dead; no living branches present on the tree
8 = new dead tree
9 = old dead or missing tree

serotina Ehrh.) to 100% on white oak, and averaged 67% on all plot trees. The only other notable damage was in the West Wawanosh Township plot in Wingham District, where approximately 80% of the 0.5-m sugar maple seedlings within a 0.5-ha area in the stand were killed by the pitted ambrosia beetle, *Corthylus punctatissimus* (Zimm.). As well, large populations of aphids (*Aphididae*, possibly *Drepanaphis* sp.) were recorded on understory regeneration.

Forest Tree Nursery Report

Ten visits were made to the St. Williams Forest Tree Nursery during the 1989 field season. A number of problems were encountered and causal agents are listed below.

The most potentially serious insect pest that the nursery had to contend with was the gypsy moth. It was responsible for various amounts of defoliation in the oak, pine and spruce seedling transplant stock. Controlled ground spraying was carried out periodically throughout the feeding period from early June to mid-July. Larvae were being blown in from surrounding deciduous woodlots, hedgerows and shelterbelts, which sustained up to 100% defoliation.

In black walnut (*Juglans nigra* L.) seedlings, a foliar anthracnose was recorded affecting about 5% of the foliage. Frost heaving affected <10% of the eastern white cedar in E4. Hedgerows of Norway spruce and white spruce contained large populations of the eastern spruce gall adelgid, which caused approximately 10% branch mortality. The larch casebearer caused up to 100% defoliation of larch windbreaks and shelterbelts. Cedar leafminer populations were recorded at endemic levels.

Climatic Data

Forest insects and diseases, during times critical to their development, can be greatly influenced by prevailing weather conditions. Forest health is also affected to a large degree by extremes in weather conditions. Baseline weather data (Table 16) are included in this report and may help in explaining variations in pest population levels and abiotic damage. The data were supplied by the Atmospheric Environment Service, Environment Canada.

Table 16. Summary of mean monthly temperatures and total precipitation at three locations in the Southwestern Region of Ontario in 1989.

Location	Month	Mean temperature				Total precipitation			
		Normal[a] (°C)	Actual (°C)	Deviation from normal (°C)	Deviation from normal (%)	Normal[a] (mm)	Actual (mm)	Deviation from normal (mm)	Deviation from normal (%)
Aylmer District									
London	Jan.	-6.6	-2.2	+4.4	+67	75.2	53.3	-21.9	-29
	Feb.	-6.1	-6.6	-0.5	-8	60.5	36.2	-24.3	-40
	Mar.	-0.9	-0.7	+0.2	+22	75.1	56.4	-18.7	-25
	Apr.	6.4	5.0	-1.4	-22	81.2	64.0	-17.2	-21
	May	12.4	13.1	+0.7	+6	66.9	84.6	+17.7	+26
	June	17.9	18.4	+0.5	+3	73.6	93.2	+19.6	+27
	July	20.3	21.3	+1.0	+5	72.4	23.4	-49.0	-68
	Aug.	19.5	19.3	-0.2	-1	80.3	55.8	-24.5	-31
	Sept.	15.4	15.0	-0.4	-3	78.6	58.2	-20.4	-26
	Oct.	9.4	9.5	+0.1	+1	73.4	79.1	+5.7	+8
	Nov.	3.1	2.0	-1.1	-35	84.7	133.7	+49.0	+58
	Dec.	-3.5	-9.9	-6.4	-182	87.5	72.2	-15.3	-17
Simcoe District									
St.Williams	Jan.	-5.7	-1.4	+4.3	+75	76.1	51.6	-24.5	-32
	Feb.	-5.2	-5.5	-0.3	-6	62.6	18.0	-44.6	-71
	Mar.	0.0	-0.4	-0.4	-2	89.2	47.2	-42.0	-47
	Apr.	6.7	4.9	-1.8	-27	97.6	58.9	-38.7	-40
	May	12.8	12.8	0.0	0	72.3	128.0	+55.7	+77
	June	18.2	18.0	-0.2	-1	73.6	111.9	+38.3	+52
	July	20.6	21.6	+1.0	+5	65.4	37.0	-28.4	-43
	Aug.	19.9	19.5	-0.4	-2	94.9	57.0	-37.9	-40
	Sept.	16.1	15.5	-0.6	-4	94.5	117.2	+22.7	+24
	Oct.	10.1	10.2	+0.1	+1	82.7	94.6	+11.9	+14
	Nov.	4.1	2.6	-1.5	-37	94.4	64.4	-30.0	-32
	Dec.	-2.5	-8.5	-6.0	-240	94.4	73.0	-21.4	-22
Wingham District									
Blyth	Jan.	-7.9	-3.0	+4.9	+62	105.8	72.5	-33.3	-31
	Feb.	-8.2	-7.4	+0.8	+10	67.2	116.0	+48.8	+73
	Mar.	-2.8	-2.1	+0.7	+25	62.7	49.8	-12.9	-21
	Apr.	5.1	4.4	-0.7	-14	71.9	84.1	+12.2	+17
	May	11.8	12.3	+0.5	+4	73.7	100.1	+26.4	+36
	June	17.0	17.1	+0.1	+1	75.0	99.5	+24.5	+33
	July	19.7	21.7	+2.0	+10	76.6	3.0	-73.6	-96
	Aug.	18.8	19.4	+0.6	+3	96.3	87.5	-8.8	-9
	Sept.	15.1	15.4	+0.3	+2	88.4	69.0	-19.4	-22
	Oct.	8.7	9.4	+0.7	+8	90.3	65.6	-24.7	-27
	Nov.	2.5	-1.4	-3.9	-156	101.4	161.4	+60.0	+59
	Dec.	-4.3	-10.7	-6.4	-149	116.2	176.3	+60.1	+52